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NAVWEPS AN 16-30ARN21-1

*B-5*

HANDBOOK  
OPERATING INSTRUCTIONS

**RADIO SET  
AN/ARN-21**

THIS PUBLICATION SUPERSEDES AN 16-30ARN21-1 DATED 15 JANUARY 1954

PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE  
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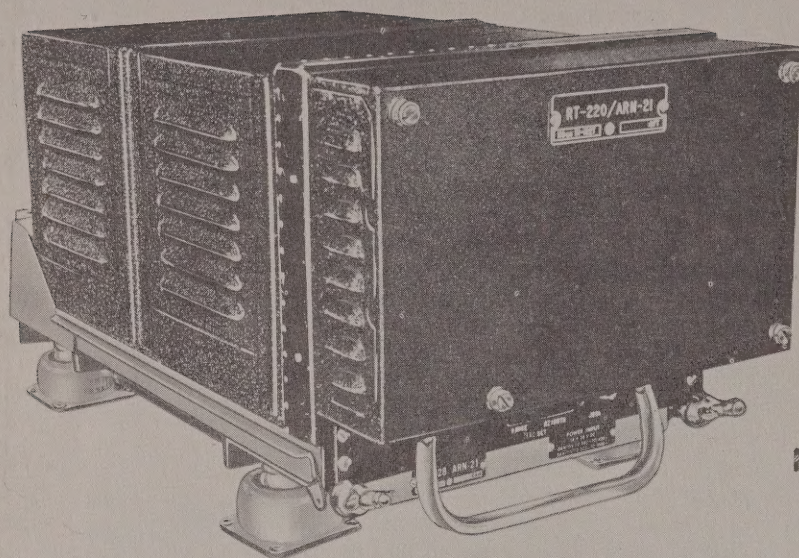
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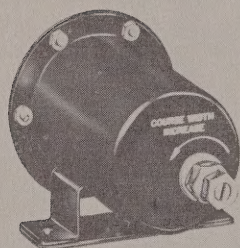
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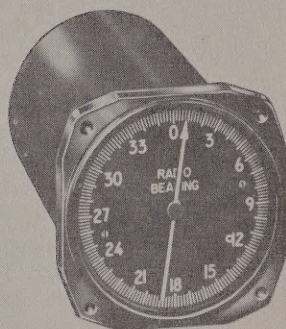


**RADIO  
RECEIVER-TRANSMITTER  
RT-220/ARN-21**

**MOUNTING  
MT-928/ARN-21**



**PHASE DETECTING NETWORK  
CV-279/ARN**



**AZIMUTH INDICATOR  
ID-307/ARN**



**RANGE INDICATOR  
ID-310/ARN**

**RADIO SET CONTROL  
C-866/ARN-21**



Figure 1-1. Radio Set AN/ARN-21



## SECTION I

## GENERAL DESCRIPTION

## 1-1. SCOPE OF THIS HANDBOOK.

1-2. This handbook includes a brief description of radio navigation equipment Radio Set AN/ARN-21, its function, capabilities and limitations, and operating procedures.

## 1-3. PURPOSE OF EQUIPMENT.

1-4. Radio Set AN/ARN-21 (figure 1-1) is an airborne equipment designed to operate in conjunction with a surface navigation beacon such as Radio Set AN/URN-3. The airborne and surface equipments form a radio navigation system which enables an equipped aircraft to obtain continuous indications of its distance and bearing from any selected surface beacon located within a line-of-sight distance from the aircraft up to 195 nautical miles. The bearing information and distance information are displayed on two separate indicators known as the "azimuth indicator" and the "range indicator."

## 1-5. GENERAL PRINCIPLES OF OPERATION.

1-6. Since the airborne AN/ARN-21 and the surface ship or shore AN/URN-3 are associated equipments, it will be helpful to first understand the basic overall system which employs the interrogator-responder principle. Figure 1-2 is a simplified block diagram of the overall system.

1-7. DISTANCE INDICATIONS. Both the airborne interrogator, Radio Set AN/ARN-21, and the ground, or shipboard, beacon, Radio Set AN/URN-3 have a receiver and a pulsed transmitter. The AN/ARN-21 transmitter, part of Receiver-Transmitter, Radio RT-220/ARN-21, initiates the interrogation process by radiating pulse signals. These signals, known as distance interrogation pulses, are detected at the particular receiver of the land or ship-based Radio Set AN/URN-3 installation to which the pilot has tuned his equipment. They, in turn, cause the beacon to respond with its own transmitted pulses.

1-8. The beacon response pulses are received by the receiver portion of Receiver-Transmitter, Radio RT-220/ARN-21. Special range circuits measure the time elapsed between transmission of the interrogation pulse and the reception of the response signal. Other range circuits then convert the time difference into a meter indication which is displayed on Range Indicator ID-310/ARN.

1-9. BEARING INDICATIONS. Besides the response pulse, the AN/URN-3 transmits a continuous reference signal consisting of a series of radio frequency pulses. These signals can be received by the receiver portion of Receiver-Transmitter, Radio RT-220/ARN-21 at any time during which the receiver portion is in operation. This pulse information is displayed as a bearing indication on Azimuth Indicator ID-307/ARN. Bearing information may be received even though interrogation pulses are not being transmitted by Radio Set AN/ARN-21. Under favorable reception conditions, bearing information from beacons beyond the 195 mile limit of the range indicator is displayed on the azimuth indicator.

1-10. TONE IDENTIFICATION. Whenever bearing signals alone, or both bearing and range signals are being received, a three letter tone identification signal in International Morse Code is also received by Radio Set AN/ARN-21. The audio signal may be heard in the pilot's headset when this unit is plugged into the normal headset connector in the aircraft.

## 1-11. CAPABILITIES AND LIMITATIONS.

1-12. For distance-measuring purposes, use of Radio Set AN/ARN-21 is dependent upon the satisfactory operation of a Radio Set AN/URN-3 beacon equipment at a maximum line-of-sight distance of 195 miles. A wide range of channels to choose from (126 in all), however, increases the probability of locating a beacon equipment within the distance limit. An operator, knowing his approximate location, can select a nearby beacon (by referring to a chart which pinpoints all AN/URN-3 beacon stations in the area) and navigate by it. Radio Set AN/ARN-21 provides a peak power output of at least 1 kw up to 35,000 feet. Above that height, its power output is automatically cut in half by an altitude switch. It is designed to operate only at altitudes up to 50,000 feet above sea level.

1-13. Radio Set AN/ARN-21 is so designed that, when the correct bearing and distance information cannot be determined the indicators will "search," that is rotate rapidly so that the operator will be unable to derive improper information from them.

## 1-14. EQUIPMENT SUPPLIED.

1-15. The equipment supplied with Radio Set AN/ARN-21 is shown in figure 1-1 and listed in Table I, below.



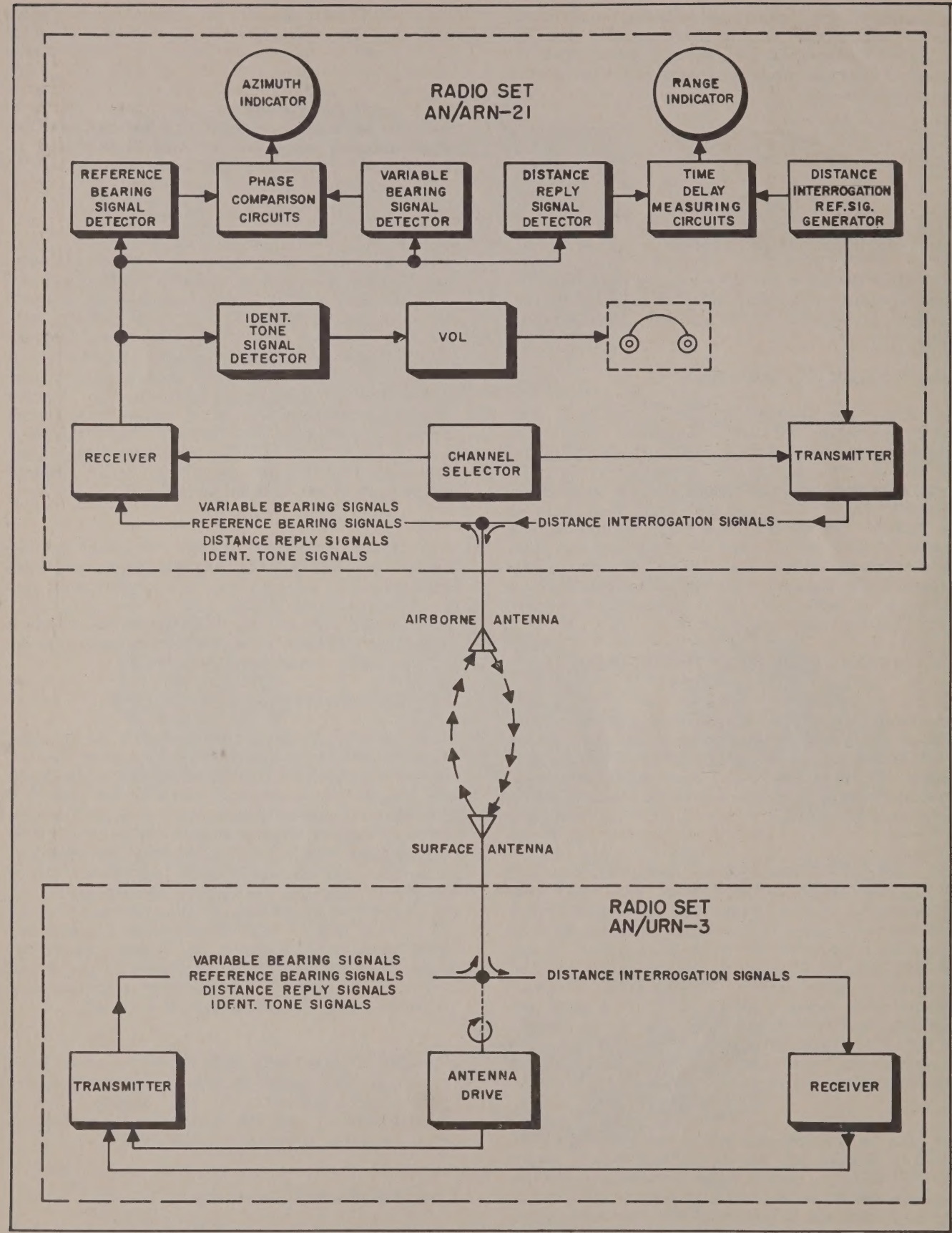


Figure 1-2. Overall System Simplified Block Diagram



TABLE I. EQUIPMENT SUPPLIED

Quantity Per Equipment	AN Nomenclature	
	Name Portion	Type Portion
1	Receiver-Transmitter, Radio	RT-220/ARN-21
1	Mounting	MT-928/ARN-21
1	Indicator, Azimuth	ID-307/ARN
1	Indicator, Range	ID-310/ARN
1	Control, Radio Set	C-866/ARN-21
1	Network, Phase Detecting	CV-279/ARN

## 1-16. EQUIPMENT REQUIRED BUT NOT SUPPLIED.

1-17. Table II, below, lists the equipment required to operate Radio Set AN/ARN-21 but not supplied as part of it.

## 1-18. ACCESSORY EQUIPMENTS.

1-19. Table III lists accessory equipments which are frequently interconnected with Radio Set AN/ARN-21 to be used in conjunction with it.

## 1-20. DESCRIPTION OF MAJOR COMPONENTS.

1-21. RECEIVER-TRANSMITTER, RADIO RT-220/ARN-21. (Figure 1-3.) The RT-220/ARN-21 radio receiver-transmitter, shown in figure 1-3, consists

TABLE II. EQUIPMENT REQUIRED BUT NOT SUPPLIED

Quantity Per Equipment	AN Nomenclature		Required Characteristics
	Name Portion	Type Portion	
1	Antenna	AS-572/ARN-21 or AS-133/APX or AT-234/APX	Vertically polarized, omnidirectional, within the frequency range of 960 to 1215 megacycles.
1	Antenna Coaxial Cable	RG-8/U	52-ohm impedance.
2	Coaxial Plug	UG-59B/U	For antenna connection.
2	Right Angle Adapter	UG-212B/U	For antenna connection.
1	Straight Plug or	AN-3106-18-1S	
1	Angle Plug	AN-3108-18-1S	
1	Straight Plug or	AN-3106A-18-1P	
1	Angle Plug	AN-3108A-18-1P	
1	Straight Plug or	AN-3106A-18-9S	
1	Angle Plug	AN-3108A-18-9S	
1	Straight Plug or	AN-3106A-20-27P	
1	Angle Plug	AN-3108A-20-27P	
1	Straight Plug or	AN-3106A-22-14P	
1	Angle Plug	AN-3108A-22-14P	
2	Straight Plug or	AN-3106A-22-14S	
2	Angle Plug	AN-3108A-22-14S	
1	Straight Plug or	AN-3106B-28-12S	
1	Angle Plug	AN-3108B-28-12S	
1	Straight Plug or	AN-3106B-28-21S	
1	Angle Plug	AN-3108B-28-21S	
3	Cable Clamp	AN-3057-10	
3	Cable Clamp	AN-3057-12	
2	Cable Clamp	AN-3057-16	



TABLE III. ACCESSORY EQUIPMENT

Quantity Per Equipment	AN Nomenclature		Function
	Name Portion	Type Portion	
1	Course Indicator	ID-249( )/ARN	Provides for radial course selection and furnishes deviation indication.
1	Cable Clamp	AN-3057-10	
1	Cable Clamp	AN-3057-16	
1	Course Indicator	ID-250/ARN	Provides for true and relative bearing indication and heading indication.
1	Cable Clamp	AN-3057-16	
1	Fluxgate Compass (or compass amplifier)	G-2	Furnishes navigation compass indication.
1	Straight Plug or	AN-3106-10SL-3S	
1	Angle Plug	AN-3108-10SL-3S	
1	Straight Plug or	AN-3106B-28-12S	
1	Angle Plug	AN-3108B-28-12S	

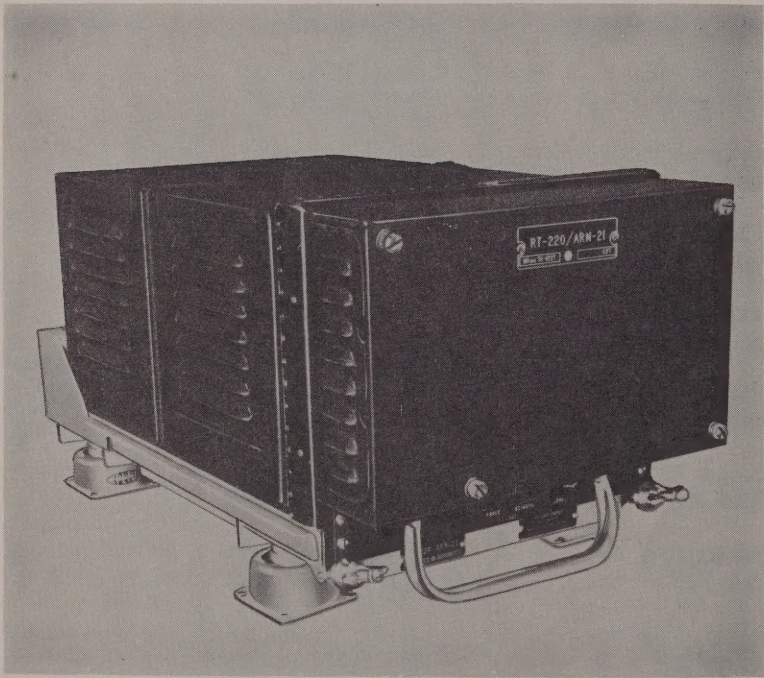


Figure 1-3. Receiver-Transmitter, Radio RT-220/ARN-21



of a base assembly, front panel assembly, eleven removable sub-assemblies, and a dust cover. The overall dimensions of the receiver-transmitter are 18-3/4 inches long by 11-1/8 inches wide by 8-5/16 inches high. The weight is approximately 60 pounds.

1-22. The base assembly consists of an aluminum alloy chassis designed to accommodate ten removable sub-assemblies. Eight of these sub-assemblies are located on top of the base assembly while the remaining two are located on the underside, along with the tuning drive mechanism and a fan to provide air circulation. The eight sub-assemblies are, front to rear: (1) Modulator, Radio; (2) Transmitter-Preselector; (3) Gate, Electronic Range; (4) Control, Electronic Range; (5) Control, Electronic Azimuth; (6) Gate, Electronic Azimuth; (7) Decoder, Video; and (8) Power Supply. These are all plug-in type sub-assemblies with the exception of the Transmitter-Preselector. The two removable sub-assemblies located on the underside of the base assembly are (1) I-F Amplifier and (2) R. F. Oscillator.

1-23. The front panel assembly is attached to the base assembly. It consists of a heavy aluminum alloy panel on the front of which are mounted the tuning drive channel selector motor, motor control circuit, crystal turret, and the frequency tripler stage (V1303, a JAN 2C39A tube). These are all protected by means of a black finish cover which extends across the upper portion of the front panel. Below the panel cover are mounted the antenna connector, and access holes for the RANGE ZERO SET and AZIMUTH ZERO SET adjustments. The Frequency Multiplier, a plug-in type sub-assembly, is secured to the rear of the front panel assembly.

1-24. The RT-220/ARN-21 radio receiver-transmitter transmits interrogation pulses, receives beacon pulses and prepares the received information for display on the bearing and distance indicators. The transmitter section transmits pulse signals in the frequency range of 1025 to 1150 megacycles. The receiver section operates in the frequency ranges of 962 to 1024 and 1151 to 1213 megacycles. There are 126 frequency channels, any one of which may be selected by setting the proper controls on Control, Radio Set C-866/ARN-21.

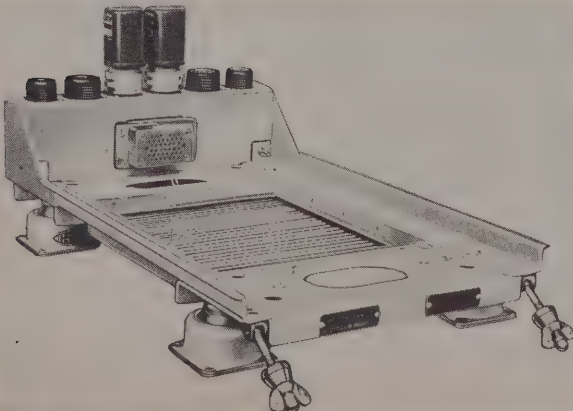


Figure 1-4. Mounting MT-928/ARN-21

1-25. MOUNTING MT-928/ARN-21. (Figure 1-4.) The receiver-transmitter is secured to Mounting MT-928/ARN-21 by means of two studs at the rear and two wing nuts at the front of the mounting. This mounting base, which is designed to be installed as an integral part of the aircraft, permits restrained movement of the receiver-transmitter thereby minimizing the effects of shock and vibration.

1-26. A housing across the rear of the mounting base serves to mount two power control relays and four cable connectors for external connections. All wiring is concealed within the housing and all connections between the mounting base and the receiver-transmitter are made by means of a 45-contact, self-aligning connector.



Figure 1-5. Indicator, Azimuth ID-307/ARN

1-27. INDICATOR, AZIMUTH ID-307/ARN. (Figure 1-5.) The ID-307/ARN bearing indicator is an instrument designed for aircraft panel mounting. The overall dimensions are 6-5/8 inches long by 3-1/8 inches in diameter. The approximate weight of the indicator, including connector plug, is three pounds. The bearing indicator is designed for mounting either from the front or from the rear, according to the installation requirements. The ID-307/ARN has a dial face calibrated from zero to 360 degrees. It has a single centrally pivoted pointer, electronically controlled by the RT-220/ARN-21 azimuth circuits, which indicates the bearing from the aircraft to the beacon to which the AN/ARN-21 is tuned. While the indicator is "searching" for the correct bearing, the pointer rotates at a rate which prevents course readings.

1-28. INDICATOR, RANGE ID-310/ARN. (Figures 1-6 and 1-7.) The ID-310/ARN distance indicator is also designed for aircraft panel mounting. The overall dimensions are 7-1/4 inches long by 3-1/8 inches



Figure 1-6. Indicator, Range ID-310/ARN  
(Red Flag Showing)



Figure 1-7. Indicator, Range ID-310/ARN  
(Red Flag Hidden)



Figure 1-8. Control, Radio Set C-866/ARN-21



in diameter. The approximate weight of the indicator, including connector plug is 2-1/2 pounds. The ID-310/ARN is designed for mounting either from the front or from the rear, according to the installation requirements.

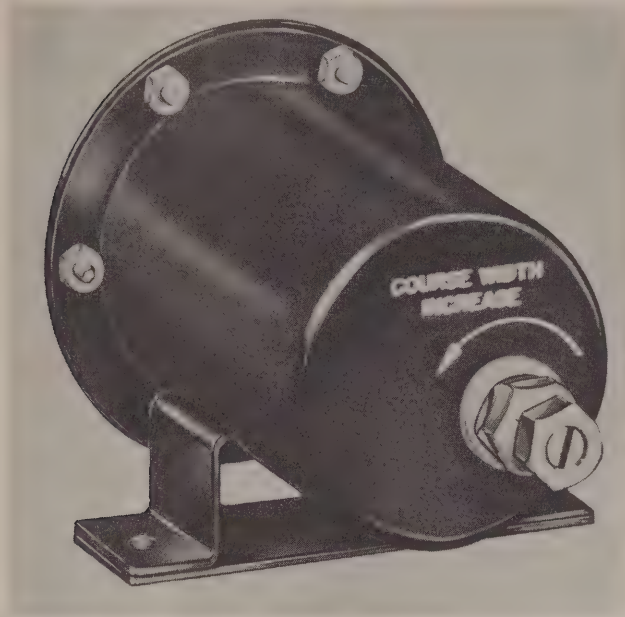


Figure 1-9. Network, Phase Detecting CV-279/ARN

1-29. The ID-310/ARN has a single window through which distance is indicated in nautical miles between the aircraft and the surface beacon. The numerals in this window are electronically controlled by the receiver-transmitter range circuits, and serve to display the results computed electronically by these circuits. The maximum range of the ID-310/ARN is 195 nautical miles. While the indicator is "searching" for the correct range, the rapidly rotating numbers are partially covered by a red flag (as shown in figure 1-6) which warns the operator against reading incorrect distance indications.

1-30. CONTROL, RADIO SET C-866/ARN-21. (Figure 1-8.) The radio set control marked NAV on the panel contains the channel selector knobs, pilot's identity tone level control, and the OFF, REC, T/R switch for energizing the equipment. It is designed for aircraft panel mounting. Back-panel lighting of the radio set control provides illumination of all front panel lettering when the AN/ARN-21 is turned on. The overall dimensions are 2-1/4 inches high by 5-3/4 inches wide by 4-3/4 inches deep. The approximate weight, including connector plug, is 1-1/2 pounds.

1-31. Frequency selection is accomplished by turning the two knobs, marked CHAN on the radio set control. The setting of the right-hand knob determines the units figure of the channel number, while the left-hand knob determines the tens and hundreds figure of the channel number. The toggle switch to the left of the channel selector knob has three positions. The bottom position, marked OFF, turns the complete equipment off. The center position, marked REC, turns on the equipment so that only bearing information is displayed. The top position, marked T/R, operates the equipment so that both bearing and distance information is displayed. When the audio output from the equipment is connected to the pilot's headphones, the control marked VOL is used to regulate the level of the audio signal which is coded to identify the surface beacon to which the equipment has been tuned.

1-32. NETWORK, PHASE DETECTING CV-279/ARN. (Figure 1-9.) The CV-279/ARN phase detecting network is a sealed unit measuring 4-7/8 inches long by 3 inches wide by 2-3/4 inches high, weighing approximately 8-3/4 ounces. The phase detector is used to relay the AN/ARN-21 bearing signals to Course Indicator ID-249( )/ARN in such a manner that deviation of the aircraft course to the left or right of the AN/URN-3 beacon will be indicated by the vertical cross-pointer of Course Indicator ID-249( )/ARN. The CV-279/ARN is usually adjusted so that at 10 degrees off selected bearing two dots deflection of the left-right pointer of the ID-249( )/ARN is produced.

## SECTION II

### OPERATING PROCEDURES

#### 2-1. PERFORMANCE AND FUNCTIONS OF EQUIPMENT.

2-2. The primary purpose of Radio Set AN/ARN-21 is to give bearing and distance information to an aircraft about a ground position equipped with a Radio Set AN/URN-3 beacon. It also determines the identity of the beacon and indicates the dependability of the beacon signal. It may also provide fly left or fly right instructions for approaching a beacon, depending upon whether Course Indicator ID-249/ARN is installed and operating in conjunction with the AN/ARN-21.

#### 2-3. FUNCTION OF OPERATING CONTROLS.

2-4. All airborne operating controls are located on Radio Set Control C-866/ARN-21, marked NAV on the panel. These controls (shown in figure 2-1) and their functions are as follows:

2-5. The OFF, REC, T/R switch is a three position toggle switch. The bottom, or OFF, position de-energizes all AN/ARN-21 equipment. The center, or REC, position places only the receiver portion of the receiver-transmitter into operation. When the switch is in this position, only bearing information is furnished by the AN/ARN-21 equipment. When the switch is in its top, or T/R position, the AN/ARN-21 interrogates the AN/URN-3 beacon and receives a signal which produces both distance and bearing on the proper indicators.

2-6. The CHAN selector consists of two rotary switches with knobs and dial skirts for selecting the desired navigation beacon channel. The left-hand knob selects the tens and hundreds figures of the beacon channel number and the right-hand knob selects the units figures of the beacon channel number. Combinations of dial settings may be made from 00 to 129.

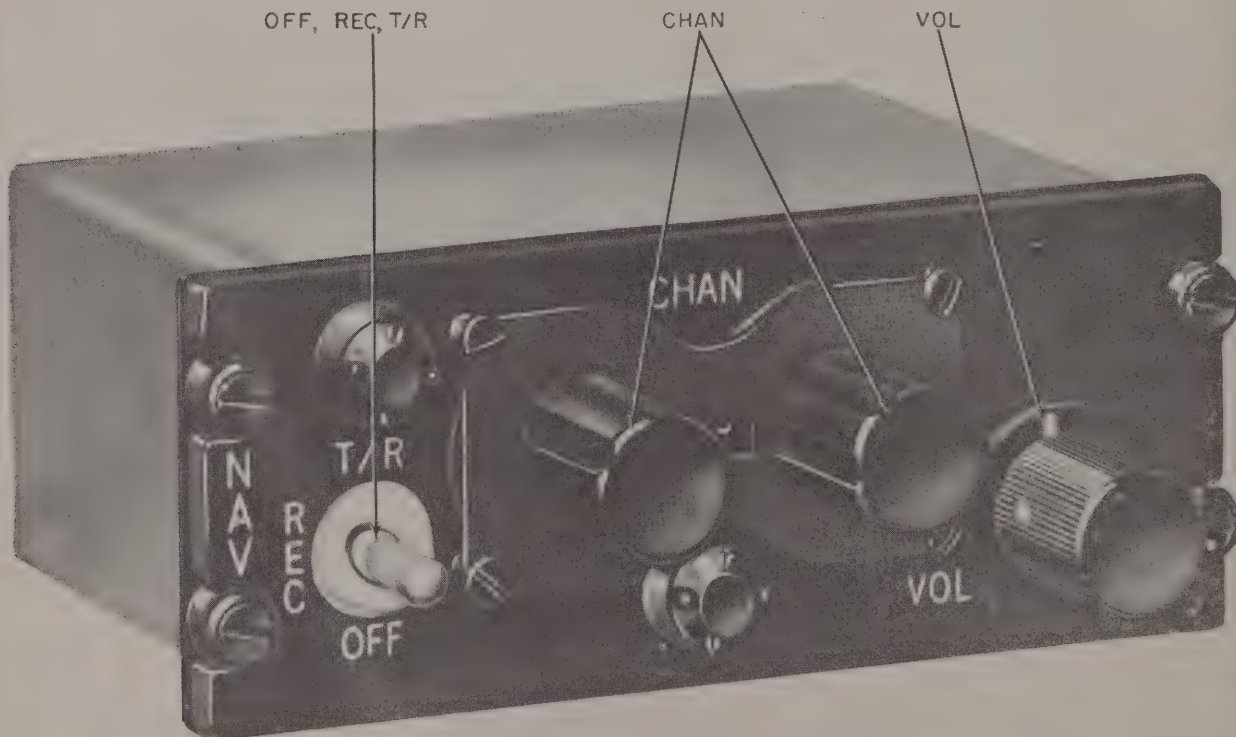


Figure 2-1. Radio Set AN/ARN-21 Operating Controls



However, the equipment only operates on channels 01 to 126, a total of 126 channels.

**CAUTION**

No attempt should be made, at any time, to set the CHAN dial below channel 01 or above channel 126.

2-7. VOL. This is a volume control which is used to adjust the volume of an audio identification signal received from the beacon. The identification signal, audible in the pilot's headphones when they are connected to the regularly used audio jack, consists of a two or three letter tone signal in International Morse Code.

**2-8. OPERATIONAL PRECAUTIONS.**

2-9. The operating controls and indicators of Radio Set AN/ARN-21 are designed to reduce to a minimum the possibility of error or misinterpretation in the use of the equipment.

2-10. Azimuth Indicator ID-307/ARN prevents an incorrect bearing reading by rapid rotation of the bearing pointer until the proper signal is received. The pointer then will remain quite steady on the correct bearing.

2-11. Range Indicator ID-310/ARN also searches until it can provide the proper distance indication. During the time that it is searching, the distance indicator is covered by a red flag which partially hides the counter numbers from the pilot's view. The distance indicator may stop momentarily at spurious signals. However, when a spurious indication is shown the red flag should only drop off for a moment and return almost immediately afterward, whereas in the case of the true bearing indication, the flag should remain hidden as long as the AN/ARN-21 remains tuned to the beacon signal.

2-12. The operating controls are limited in number to three. Of those three, incorrect settings of the OFF, REC, T/R switch or VOL control would probably not cause any serious error. Incorrect setting of the OFF, REC, T/R switch could only prevent a display of distance information or break radio silence. Incorrect setting of the VOL control could only interfere with the pilot's hearing the beacon audio identification signal. The only control whose incorrect setting could probably cause serious misunderstanding is the CHAN control.

**CAUTION**

The pilot should always check the CHAN setting on his control box to make certain that any displays on the indicators of Radio Set AN/ARN-21 are the displays initiated by the desired AN/URN-3 beacon, and not the displays of a beacon on a different channel, and at a different location, which he has selected in error.

**2-13. OPERATING PROCEDURES.**  
(Refer to figure 2-1.)

2-14. START-STOP PROCEDURE. Starting and stopping of the AN/ARN-21 is controlled by the OFF, REC, T/R switch on the NAV panel. When this switch is in OFF position, all power is turned off. When the switch is in either REC or T/R position, the equipment is turned on. No other AN/ARN-21 control settings need be made to turn the equipment on or off. The control panel illumination is controlled by the aircraft lighting system and does not indicate the condition of the equipment.

**Note**

When the equipment is turned on, there is a normal warmup delay of 90 seconds. There is no delay when going from REC to T/R.

2-15. OPERATION. When the equipment is turned on, it is operated as follows:

2-16. CHANNEL SELECTION. Select a known beacon channel by setting the CHAN dials on the NAV panel at the appropriate channel number.

2-17. BEARING INDICATION. The bearing of the beacon selected by the CHAN selector is indicated on Azimuth Indicator ID-307/ARN when the OFF, REC, T/R switch is in either REC or T/R position.

2-18. DISTANCE INDICATION. The distance between the aircraft and the selected beacon is indicated on Range Indicator ID-310/ARN only when the OFF, REC, T/R is in T/R position. Distances from zero to 195 miles are displayed.

2-19. BEACON IDENTIFICATION. Identification of the selected beacon is accomplished by listening to the call letters spelled out in International Morse Code over the regular headphones. The strength of this tone signal is adjusted by the VOL control on Radio Set Control C-866/ARN-21 NAV panel.



### SECTION III

#### OPERATING CHECKS AND ADJUSTMENTS

##### 3-1. GENERAL.

3-2. The operating checks and adjustments given in this section include both preflight checks and flight checks. Once the aircraft is airborne, there are no adjustments which can be made on the equipment, other than adjustment of the identification signal tone level. Preflight checks, although indicated in this handbook for the information of the operator, should generally be performed by maintenance personnel at periods in which the aircraft is available for maintenance.

##### 3-3. PREFLIGHT CHECKS AND ADJUSTMENTS.

3-4. Preflight checks and adjustments should be made with the assistance of a local operative Radio Set AN/URN-3 beacon. In order to perform the checks and adjustments, the aircraft should be positioned at a point on the runway whose exact distance and bearing with relation to the AN/URN-3 beacon are known. The distance should be at least one half mile. The checks and adjustments should be made as follows:

- a. Locate the aircraft at the chosen testing location.
- b. Set the CHAN selector on the NAV panel to a channel other than the one chosen for the check. Set the VOL control half way between its extreme clockwise and counterclockwise settings.
- c. Set the OFF, REC, T/R switch to REC. Allow the AN/ARN-21 a warm-up period of 90 seconds. At the end of that period, the ID-307/ARN bearing indicator pointer should begin spinning.
- d. Turn the CHAN selector to the channel of the local AN/URN-3 beacon. The ID-307/ARN pointer should stop in a position which indicates the location of the beacon relative to the aircraft.
- e. If there is a deviation between the indicator reading and the predetermined bearing of the beacon radio set, the AZIMUTH ZERO SET screwdriver control may need adjusting for the proper bearing indication on the ID-307/ARN. However, it should first be determined that such error is not due to local siting or reflection effects.

##### Note

The AZIMUTH ZERO SET and RANGE ZERO SET screwdriver controls are located on the bottom of the Receiver-Transmitter, Radio RT-220/ARN-21 front panel.

- f. Place the OFF, REC, T/R switch in T/R position. After a short period of searching, the flag on the ID-310/ARN distance indicator dial should move up behind the meter face to display the distance between the aircraft and the local beacon. (The bearing indication of the ID-307/ARN should not change.)

- g. If the deviation between the range indicator reading and the predetermined distance of the beacon radio set is incorrect, adjust the RANGE ZERO SET screwdriver control for the correct distance indications.

- h. Plug a pair of headphones into the regular pilot's headphone jack. A tone identification signal should be heard. Adjust the VOL control on the Radio Set Control C-866/ARN-21 NAV panel for the desired signal strength.

- i. Turn the CHAN selector to a channel other than that of the local AN/URN-3 beacon. The tone signal in the headphones should cease, the bearing indicator pointer should start searching, and the red flag should come up over the numbers on the range indicator.

- j. Shut down the equipment by placing the OFF, REC, T/R switch in OFF position.

##### 3-5. FLIGHT CHECKS.

3-6. In order to check the AN/ARN-21 equipment while the aircraft is in flight, proceed as follows:

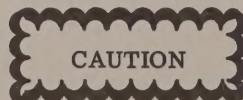
- a. Turn the AN/ARN-21 on by placing the OFF, REC, T/R switch in REC position. Set the CHAN dials for an unused beacon channel. After approximately 90 seconds, the pointer on the ID-307/ARN azimuth indicator should begin searching.

- b. Turn the CHAN selector dials to the channel of an AN/URN-3 beacon known to be within a radius of 195 miles of the aircraft position, and at a line of sight location. Note the bearing indication on the azimuth indicator when the pointer comes to rest. This bearing should correspond with the bearing information about the beacon location as determined by other reliable navigational means.

- c. Place the OFF, REC, T/R switch in T/R position. Note the bearing and distance information as furnished by the azimuth and range indicators, respectively. Compare these with the bearing and distance information about the beacon location as determined by other reliable navigational means.

- d. Adjust the VOL control until the beacon audio signal can be heard in the headphones. This signal should be the established identification letters of the selected radio beacon.

- e. Where possible, take additional bearings on AN/URN-3 beacons operating on other channels of the AN/ARN-21 equipment, and at a distance within the 195 mile radius.



Do not perform any adjustments on the AZIMUTH ZERO SET and RANGE ZERO SET controls while the aircraft is airborne.



## SECTION IV

## EMERGENCY OPERATION

## 4-1. DEFECTIVE OPERATION.

4-2. If, for any reason, Radio Set AN/ARN-21 is not functioning satisfactorily, bearing and distance information cannot be read from the ID-307/ARN and ID-310/ARN indicators because the indicators are continuously searching. Thus the operator is prevented from obtaining incorrect navigation information from the equipment.

## 4-3. POSSIBLE CAUSES OF FAULTY OPERATION.

4-4. Faulty operation may not necessarily be due to a defect in the AN/ARN-21 equipment. A defect in the ground or shipboard beacon may be the cause of operating failure, or the beacon may be at too great a distance, or there may be some obstruction in the line-of-sight path (such as a mountain or the curvature of the earth due to the low altitude of the aircraft). Any of the above causes would prevent bearing and distance indications. If, on the other hand, the operating failure is due to a defect in the AN/ARN-21 equipment, it may prevent its use only on particular channels.

## 4-5. EMERGENCY OPERATION.

4-6. If satisfactory distance and bearing indications

are not available on a particular channel, switch to another channel known to be on the air within the 195 mile range (if such a channel is available). If satisfactory distance and bearing indications are received for the alternate channel, and the proper code signals are heard, it may be assumed that the AN/ARN-21 equipment is operating properly. Once the equipment has been checked on an alternate channel, the operator should return to his original channel to assure himself that the faulty indication was not the result of a temporary pause in beacon transmission, or a temporary obstruction between the aircraft and beacon which prevented proper reception. If a second attempt fails to provide bearing and distance information on the original channel, either select an alternate channel for navigation purposes, or employ other navigational means.

4-7. Defective operation may also appear as the result of a faulty transmitter or range unit while the azimuth circuits are still operable. If this is the case, satisfactory beacon bearing information can be obtained by placing the OFF, REC, T/R switch in REC position (thus only employing the RT-220/ARN-21 receiver section). In this manner bearing information on a particular beacon is available, even though distance information is not.



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